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Effect of feeding decorticated cottonseed cake on growth performance of crossbred calves

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Abstract

To observe the effects of partial replacement of soybean (de-oiled) meal with cottonseed expeller or decorticated solvent extracted cottonseed cake on voluntary feed intake,; growth of calves; blood profile and feed efficiency; 18 Karan fries female calves of similar age (8-9 months) and body weight (114-115 kg) were randomly divided into three groups of each and allotted diets 'C', 'T-1' or 'T-2'. The diet 'C' having 15% soybean meal, which was replaced by 10 parts with cottonseed cake expeller in 'T-1' diet or 10 parts by decorticated cottonseed cake solvent extracted in 'T-2' diet. All the crossbred female calves were fed individually rations (wheat straw: concentrate 50:50) along with 10kg oats green fodder/ animal/ day. Body weight was recorded fortnightly and blood samples collected at monthly intervals. The average daily gains were observed to be significantly higher ($P \leq 0.05$) in group 'T-2' (750 ± 51 g/day) than group 'C' (634 ± 61 g/day) and group 'T-1' (583 ± 37 g/day). Nitrogen balance was significantly higher in 'T-2' (37.30 ± 5.61) and 'C' (30.95 ± 2.61) than 'T-1' (28.78 ± 1.14), all animals were found in positive nitrogen balance. Blood urea nitrogen was significantly higher ($P \leq 0.05$) in 'T-2' (18.08 ± 0.64) than 'C' (14.77 ± 0.61) and 'T-1' (14.67 ± 0.58) while blood glucose, total protein, albumin, globulin, albumin: globulin ratio and haemoglobin not differ significantly in all three groups. The cost for per kg body weight gain was (Rs) 73.65, 69.38 and 56.78 in 'C', 'T-1' and 'T-2' respectively. It can be concluded that soybean meal de-oiled can be replaced 10 parts with decorticated solvent extracted cottonseed cake to have higher growth rate; nutritive digestibility; nutritive evaluation and feed conversion efficiency in growing female calves.

Keywords: Cottonseed cake, decorticated cottonseed cake, growth performance, cross breed calves

Introduction

Cotton is very important cash crop in Punjab, Haryana, Maharashtra and Gujarat. After removing the cotton fibre, the seeds are available for oil production. Because of use of cottonseed oil in vegetable ghee preparation, the expeller pressed cotton seed or decorticated cottonseed cake is becoming available for animals. Hence, it will be in the interest of the animal nutritionists to know their nutritive value for ruminants. As also now a day due to increased prices and less availability of soybean meal dairy farmers are seeking a suitable and viable alternate protein supplement to soybean meal or full fat soybean (extruded). Among the alternatives cotton seed meal (solvent extracted) is one which contain 38-44% crude protein, though it contain less protein than soybean meal de-oiled (47%) but matches to soybean full fat as a protein source (38%).

^[1] Reported that cottonseed cake (undecorticated) has higher degradable protein (47.0%) compared to groundnut cake Whole cottonseed is high in protein, energy and fiber. It is also a good, though, variable source of thiamine but a poor source of carotene. The nitrogen balance was measured as the nitrogen intake through feed, nitrogen outgo through faeces and nitrogen outgo through urine. Blood urea nitrogen values (mg/dl) were significantly higher in 'T-2' (18.08 ± 0.64) compared to other (14.77 ± 0.61 , 14.67 ± 0.58).

Material and methods

For in vivo study, 18 Karan fries female calves of similar age (8-9 months) and body weight (114-115 kg) were randomly divided into three groups of six animals in each group and allotted diets 'C', 'T-1' or 'T-2'. Basal diet was oats green and wheat along with concentrate mixture with 20% crude protein. The ingredients and chemical composition of the experimental diet presented in table 1. The soybean meal was replaced by 10 parts with cottonseed cake expeller in 'T-1' diet or 10 parts by decorticated cottonseed cake solvent extracted in 'T-2' diet.

All the crossbred female calves were fed individually rations (wheat straw: concentrate 50:50) along with 10kg oats green fodder/ animal/ day. Body weight was recorded fortnightly and blood samples collected at monthly intervals from all the animals by jugular puncture in heparinised vacutainer, mixed well and brought to the laboratory after placing on ice. Haematological parameters were analyzed immediately in fresh blood sample in automatic blood analyzer. Then, the samples were centrifuged at 3000 rpm for 15 minutes to separate the plasma. The plasma samples were stored at -20

°C for the estimation of glucose, blood urea nitrogen (BUN), total protein, albumin, and globulin.

Result and Discussion

Ingredient composition

The ingredient and composition was same in all three groups except that 'C' have 15% soybean meal out of which 10 parts replaced by cottonseed cake expeller in 'T-1' and decorticated cottonseed cake (sol. ext.) in 'T-2'.

Table 1: Ingredient and chemical composition of experimental concentrate mixtures fed to female crossbred calves.

Ingredients	Groups		
	C	T-1	T-2
Maize grain	28	28	28
Bajra	5	5	5
Mustard oil cake	13	13	13
Ground nut cake	10	10	10
Wheat bran	15	15	15
Rice polish	11	11	11
Soybean meal	15	5	5
Cotton seed cake (Expeller)	-	10	-
Decorticated cottonseed	-	-	10
Salt	1	1	1
Mineral mixture	2	2	2
Urea	-	1	0.25
Chemical composition			
Dry matter	90.2	90.3	91.1
Organic matter	90.4	90.9	90.2
Crude Protein	19.1	20.0	19.9
Crude fiber	10.8	10.4	9.4
Ether extract	4.2	6.2	4.8
Nitrogen free extract	56.3	52.0	55.8
Total ash	9.6	9.1	9.8
Acid insoluble ash	1.8	1.4	1.1
Neutral detergent fibre	36.2	31.7	33.8
Acid detergent fibre	15.1	15.2	12.7
Hemicellulose	21.1	16.5	21.1

Table 2: Percent chemical composition of concentrate mixtures SBM 'C', 'T-1' (replacing 10 parts of soybean meal with cottonseed cake expeller), 'T-2' (replacing 10 parts of soybean meal with decorticated cottonseed cake), green oats and wheat straw (on DM basis)

Parameters	Groups			Oat fodder	Wheat straw
	SBM 'C'	CSC 'T-1'	DCSC 'T-2'		
Dry matter	90.2	90.3	91.1	16.0	90.6
Organic matter	90.4	90.9	90.2	88.5	91.6
Crude Protein	19.8	20.0	19.9	8.5	2.6
Crude fibre	10.8	10.4	9.4	42.3	33.1
Ether extract	4.2	6.2	4.8	2.7	0.9
Nitrogen free extract	56.3	52.0	55.8	44.2	45.8
Total ash	9.6	9.1	9.8	11.5	8.4
Acid insoluble ash	1.8	1.4	1.1	3.6	4.0
Neutral detergent fibre	36.2	31.7	33.8	63.2	81.6
Acid detergent fibre	15.1	15.2	12.7	43.0	57.1
Hemicellulose	21.1	16.5	21.1	20.2	24.5

Voluntary DM intake and body weight gain

The average dry matter intake kg/day was 4.41 kg in 'C', 3.83 in 'T-1' and 4.04 in 'T-2' which was similar. Similarly, [2] also reported no difference between diets containing cottonseed oil cake meal and soybean oil cake meal in Holstein bull calves. In another [3] found no difference in respect of dry matter intake and feed conversion efficiency in groups fed with cottonseed cake and soybean oil cake meal to the Holstein and jersey heifer calves. DMI depends on so many factors including roughage to concentrate ratio, energy density, stage of growth, palatability, fibre level and so on; in the

experiment all similar conditions were there, hence, DMI not changed.

The average body weight gain was significantly ($P < 0.05$) higher in 'T-2' (750 ± 51 g/d) than 'C' (634 ± 61 g/d) and 'T-1' (583 ± 37 g/d). At the start of the experiment, the average body weight of female crossbred calves were 114.37 ± 20.35 , 113.17 ± 23.13 and 115.37 ± 26.96 for 'C', 'T-1' and 'T-2' diet groups respectively while at end of 105 days of experimental period were recorded to be 181.00 ± 23.63 , 174.50 ± 28.13 , and 194.13 ± 34.19 kg in 'C', 'T-1' and 'T-2' diet groups respectively. These cross bred calves of 'C' and

'T-2' diets showed higher gain in body weight (66.6 ± 3.96 and 78.8 ± 10.32 kg) then 'T-1' (61.3 ± 6.5 kg) diet indicating

significantly ($P < 0.05$) higher growth in 'T-2' diet then 'C' and 'T-1' diet group respectively.

Table 3: Productive performance of female crossbred calves fed with cottonseed cake (CSC) or decorticated cottonseed cake (DCSC) as a partial replacement of soybean meal SBM) in complete feed mixtures.

Particular	Groups			SEm ($P < 0.05$)
	C	T-1	T-2	
Avg. initial body weight (kg)	114.3 \pm 20.30	113.2 \pm 23.10	115.36 \pm 26.90	12.82 ^{NS}
Avg. final body weight (kg)	181 \pm 23.60	174.5 \pm 28.10	194.1 \pm 34.20	15.85 ^{NS}
Total Wt. gain(kg)	66.6 ^{ab} \pm 3.96	61.3 ^a \pm 6.50	78.8 ^b \pm 10.32	4.39*
Average daily gain 'g'	634 ^{ab} \pm 61	583 ^a \pm 37	750 ^b \pm 51	41.81*
Dry matter intake(DMI) (kg)				
a) From concentrate**	181.6 \pm 19.20	164.38 \pm 22.60	172.8 \pm 20.20	11.37 ^{NS}
b) From wheat straw**	135.4 \pm 20.53	121.4 \pm 22.20	130.2 \pm 20.70	11.57 ^{NS}
c) From green oats**	117.8 \pm 3.10	117 \pm 4.80	122.1 \pm 1.50	1.93 ^{NS}
Total dry matter intake**	434.9 \pm 42.00	402.8 \pm 46.30	425.1 \pm 41.40	23.72 ^{NS}
Average dry matter intake/day	4.14 \pm 0.40	3.83 \pm 0.44	4.04 \pm 0.39	0.22 ^{NS}
Average dry matter intake/100kgBW	2.50 \pm 0.42	2.36 \pm 0.45	2.71 \pm 0.57	0.26 ^{NS}
Average dry matter intake/kg W ^{0.75} (g)	89.10 \pm 12.74	83.41 \pm 14.46	93.88 \pm 17.34	71.53 ^{NS}
Feed conversion ratio (kg DMI/kg gain)	6.26 \pm 0.52	6.75 \pm 1.08	6.69 \pm 1.07	0.51 ^{NS}
% Feed efficiency (kg gain/ 100kg feed intake)	16.21 ^{ab} \pm 2.13	15.34 ^a \pm 0.69	18.55 ^b \pm 1.73	0.95*

Means with different superscripts ^{a, b, ab} in a row differ significantly ($P < 0.05$)

NS- Non-significant at 5% level

**105 days

Blood parameters

Blood urea nitrogen values (mg/dl) were significantly ($P < 0.05$) higher in 'T-2' (18.08 ± 0.64) compared to other (14.77 ± 0.61 in 'C' and 14.67 ± 0.58 in 'T-1'). Blood urea nitrogen and protein intake has a positive relationship and BUN value is an indicator of protein intake [4, 5]. The values for blood glucose (mg/dl), total protein (g/l), albumin (g/l),

globulin (g/l), Albumin: Globulin ratio and haemoglobin (g/dl) in control, T-1 and T-2, did not vary much and remained in normal range [6]. Showed no significant change in the blood glucose and uric acid levels in cattle fed whole cottonseed meal for 430 days. Numerically the values for glucose were found to be little lower in 'T-1' and 'T-2' diet compared to 'C' may be due to gossypol in cottonseed cakes.

Table 6: Effect of partial replacement of soybean meal with cottonseed cake (CSC) or decorticated cottonseed cake (DCSC) on blood biochemical profile in female cross bred calves

Particulars	Groups			SEm ($P < 0.05$)
	SBM 'C'	CSC 'T -1'	DCSC 'T -2'	
BUN (mg/dl)	14.77 ^a \pm 0.61	14.67 ^a \pm 0.58	18.08 ^b \pm 0.64	0.39*
Glucose (mg/dl)	60.19 \pm 1.15	60.15 \pm 0.89	59.30 \pm 0.95	0.57 ^{NS}
Total protein (g/l)	7.13 \pm 0.23	7.38 \pm 0.27	7.51 \pm 0.26	0.15 ^{NS}
Albumin(g/l)	3.72 \pm 0.10	3.86 \pm 0.07	3.66 \pm 0.11	0.05 ^{NS}
Globulin (g/l)	3.42 \pm 0.23	3.52 \pm 0.27	3.81 \pm 0.28	0.15 ^{NS}
Albumin : Globulin	1.26 \pm 0.10	1.45 \pm 0.19	1.20 \pm 0.13	0.08 ^{NS}
Haemoglobin (g/dl)	11.11 \pm 2.63	8.60 \pm 0.22	8.30 \pm 0.25	0.88 ^{NS}

Means with different superscripts ^{a, b} in a row differ significantly ($P < 0.05$)

NS- Non-significant at 5% level

* Significant ($P < 0.05$)

[7] Observed that feeding protein with high rumen un-degradable value resulted in increased concentration of blood glucose due to more glucogenic amino acids available for gluconeogenesis. However, this could not be confirmed in the present study.

Conclusion

It can be concluded that decorticated cotton seed cake (Sol. Ext.) can successfully use as a partial replacement (10 parts) of soybean meal in a concentrate mixture as it lead to higher growth rate in crossbred female calves with better feed efficiency without any adverse effect on blood biochemical profile. As the market price of decorticated cotton seed cake (solvent extract) is less than soybean meal de-oiled and it showed better growth and average daily gains than soybean meal. Thus, it will be in advantage to feed decorticated cottonseed cake solvent extracted in a concentrate mixture for a rapid rate of growth in crossbred female calves.

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